Translation of JP 2002-169225 on IDS

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the Fresnel lens sheet used for tooth-back projection form television, and its manufacture approach.

[0002]

[Description of the Prior Art] Generally from the former, the outline block diagram of the transparency mold screen used for tooth-back projection form television is shown in drawing 4 . In drawing 4 , 1 is a Fresnel lens sheet and 2 is a lenticular lens sheet. Usually, it is stuck to the Fresnel lens sheet 1 and the lenticular lens sheet 2, and the transparency mold screen is constituted. Generally, the Fresnel lens sheet consists of sheets with which the Fresnel lens which consists of a lens of an at equal intervals and concentric circular detailed pitch was prepared in the optical outgoing radiation side. The Fresnel lens has the serrate cross section which has the Fresnel lens side 4 of the direction of slant to plane of incidence 3 (drawing 5). The Quonset lens is arranged, respectively so that the lenticular lens sheet 2 may be on an optical optical plane-of-incidence and outgoing radiation side side at equal intervals. The parallel light or convergence light by which outgoing radiation was carried out from the Fresnel lens sheet is horizontally diffused greatly with the lenticular lens sheet 2, and becomes possible [observing an image in the horizontal large visual field range by this]. In order to expand the range in which image observation is possible also not only in a horizontal direction but in a perpendicular direction, the ingredient with which the dispersing agent was generally distributed is used for the lenticular lens sheet 2.

[0003] The image light L1 projected from the projection device (not shown) installed in

the tooth-back side of the transparency mold screen equipped with the Fresnel lens sheet 1 and the lenticular lens sheet 2 As shown in drawing 5 , it is refracted by the plane of incidence 3 of the Fresnel lens sheet 1 (L2), it is again refracted in respect of [4] outgoing radiation (Fresnel lens side), and outgoing radiation is changed and carried out to the convergence light which connects a focus to the location of 5-20m observation side approach from parallel light or a screen (L3). However, in case outgoing radiation is carried out from the Fresnel lens side 4, it is reflected in respect of [4] a Fresnel lens, and a part of light L4 is shut up in a Fresnel lens sheet, and is again reflected by plane of incidence 3 (L5). It is reflected in respect of [4] a Fresnel lens directly or again, this unnecessary light L5 reaches the rise side 5, and outgoing radiation is carried out from the rise side 5 (L6).

[0004] Thus, with the conventional Fresnel lens sheet, unnecessary light L6 carries out outgoing radiation from a different location not only in the light L3 which incident light L1 should carry out outgoing radiation essentially. For this reason, a ghost image occurs and contrast deteriorates remarkably. In order to suppress generating of the ghost image by unnecessary light, the technique of preparing a light absorption layer or a light-scattering layer in a rise side is known (see JP,50-123448,A, JP,52-143847,A, etc.).

[0005]

[Problem(s) to be Solved by the Invention] Although generating of the ghost image by unnecessary light could be suppressed by preparing a light absorption layer or a light-scattering layer in the rise side of a Fresnel lens sheet, there was a case where control of a ghost image was inadequate. Since a beam of light passes a light-scattering layer, without most total luminous flux of unnecessary light declining when a light-scattering layer is

prepared especially in a rise side, the contrast of image light of the thing in which a ghost image stops being conspicuous may seldom have improved. When preparing a light absorption layer in the rise side of the Fresnel lens of a minute pitch, in order to make unnecessary light fully absorb, light absorption agents, such as a carbon particle and black ink, must be carried out with ** so that it may become the thickness of about 5-10 micrometers. When a light absorption layer is prepared in a rise side, a Fresnel lens side will be interrupted only for the thickness. In order to make an image minute in recent years, there is an inclination which makes the pitch of a Fresnel lens small like 100 micrometers or less. With such a small Fresnel lens sheet of a lens pitch, the Fresnel lens side was interrupted in the light absorption layer, and when the permeability of a Fresnel lens side fell, it might be unable to be disregarded that an image becomes dark.

[0006] It was made in order that this invention might solve this technical problem, generating of the ghost image by unnecessary light is controlled, and contrast is good and it aims at offering the Fresnel lens sheet which has high permeability, and its manufacture approach.

[0007]

[Means for Solving the Problem] Many serrate Fresnel lenses constituted by the Fresnel lens side 4 which does the function of a convex lens so, and the rise side 5 located between adjacent Fresnel lens sides are arranged, acid resisting processing 7 is performed to this Fresnel lens side, and the Fresnel lens sheet of invention of this case which solves the above-mentioned technical problem is characterized by to prepare the optical diffusion layer 6 or the light absorption layer in this rise side, as the outline sectional view is shown in drawing 1 .

[0008] Here, as for the above-mentioned acid-resisting processing, it is desirable that it is what is reduced 0.2% or more, and it is more more desirable than reflection factor of Fresnel lens side in wavelength of 460nm processing-before that it is what is reduced 0.5% or more. As for an optical diffusion layer, it is desirable that it is what makes peak intensity of unnecessary light 80% or less, and it is more desirable that it is what is made 60% or less. As for a light absorption layer, what reduces the permeability of the rise side over a beam of light with a wavelength of 460nm to 80% or less is desirable, and what is reduced to 60% or less is more desirable.

[0009] The unnecessary light generated by reflecting the beam of light which the permeability of a Fresnel lens side tended to be raised and was going to carry out incidence to the Fresnel lens side can be reduced by performing acid-resisting processing to a Fresnel lens side as above-mentioned. As shown in drawing 2 which is the line route map of the beam of light which carried out incidence to the Fresnel lens sheet of invention in this case When the beam of light L2 with which the beam of light L1 which carried out incidence was refracted by plane of incidence 3 arrives at the Fresnel lens side 4 and the layer 7 by which acid-resisting processing was carried out is in the Fresnel lens side 4 Outgoing radiation of the most is carried out from a Fresnel lens sheet as a beam of light L3, and its reflected light L4 in the Fresnel lens side 4 becomes less than the case of the conventional Fresnel lens. Moreover, in case the unnecessary light L5 which arrived at the rise side by preparing an optical diffusion layer or a light absorption layer in a rise side can be made to diffuse or absorb and outgoing radiation of the beam of light is carried out from a Fresnel lens side, a part of light is reflected in respect of a Fresnel lens, generating of the ghost image by the unnecessary light which it is shut up in a Fresnel

lens sheet and produced is controlled, and contrast can be raised.

[0010] It is desirable that the above-mentioned Fresnel lens side 7 has an irregular concavo-convex front face, exists by the consistency of the range this whose irregularity is 1-100 per mu m square [of the front faces of a Fresnel lens side / 100], and is located in the range whose mean distance with the minimum point of the crevice which adjoins the minimum point of the crevice in this concavo-convex front face of a Fresnel lens side is 0.2-0.7 micrometers, and the detailed irregularity of the range whose depth is 0.05-0.2 micrometers exists in the crevice of this irregularity. An example of the sectional view showing such a concavo-convex front face is shown in drawing 3 . In drawing 3 , X shows distance with the minimum point of the crevice which adjoins the minimum point of the crevice in this concavo-convex front face of a Fresnel lens side. When a Fresnel lens side has such a concavo-convex front face, the effectiveness that it passes through the field where a refractive index changes continuously is received, the light L4 which is reflected in respect of a Fresnel lens and shut up in a lens sheet decreases, and the permeability of the beam of light which is going to carry out outgoing radiation from the interior of a Fresnel lens sheet of a Fresnel lens side improves. As for the thickness of the layer which consists of an irregular concave convex and by which acid-resisting processing was carried out, it is desirable that it is 0.3 micrometers or more.

[0011] Such a Fresnel lens sheet makes with ** the liniment liquid containing the particle of the range whose mean particle diameter is 1-50 micrometers, and the particle of the range whose mean particle diameter is 0.01-0.2 micrometers a Fresnel lens sheet surface with a spin coat method. Subsequently By removing the particle of the range whose mean particle diameter is 0.01-0.2 micrometers The optical diffusion layer or light absorption

layer which mean particle diameter becomes from the particle of the range which is 1-50 micrometers is prepared in this rise side. It is in the range whose mean distance with the minimum point of the crevice which adjoins the minimum point of a crevice in a Fresnel lens side is 0.2-0.7 micrometers. It can manufacture by making the irregular concavo-convex front face which has the detailed irregularity of the range whose depth is 0.05-0.2 micrometers in the crevice of this irregularity exist in a Fresnel lens side by the consistency of 1-100 range per mu m square [of front faces / 100].

[0012] A spin coat method is the approach of making rotate ******-ed at high speed, laying a liquid near the core of ******-ed, and applying a liquid to homogeneity all over ******-ed with a centrifugal force. Since the rise side of a Fresnel lens sheet is an abbreviation perpendicular to the front face of a lens sheet, the particle for an optical diffusion layer or light absorption stratification with a large particle size adhering to a rise side is hard to be removed even if it rotates a lens sheet at high speed. The particle for an optical diffusion layer or light absorption stratification with a large particle size which adhered to the Fresnel lens side on the other hand when the lens sheet was rotated at high speed slides on a Fresnel lens side, and scatters on the outside of a lens sheet. Therefore, only the particle for acid-resisting processing with a small particle size can be made to be able to adhere to a Fresnel lens side, and only the particle an optical diffusion layer with a large particle size or for light absorption stratification can be made to adhere to a rise side by carrying out the spin coat of the liquid containing a particle with a comparatively small particle size, and a particle with a comparatively large particle size.

[0013]

[Embodiment of the Invention] As for the magnitude of the rise angle of the Fresnel lens

sheet in invention in this case, it is desirable that it is the range of **30 degrees to the optical axis of a lens. In case preparing the irregularity whose depth is 1-10 micrometers in the front face of a rise side forms the particle for an optical diffusion layer or light absorption stratification with a spin coat method, it is desirable at the point that this particle can be made to adhere much more alternatively according to a rise side.

[0014] As each particle used in invention of the manufacture approach in this case, resin powder, inorganic glass powder, a pigment, etc. can be used. It mixes with water, an organic solvent, a binder, etc., and these particles are used.

[0015] It needs to be cautious of the combination of the particle for an optical diffusion layer or light absorption stratification, and the particle for acid-resisting processing. That is, in case acid-resisting processing which removes the particle for acid-resisting stratification and becomes a Fresnel lens side from an irregular concavo-convex front face is performed, each particle must be chosen so that the particle for an optical diffusion layer or light absorption stratification adhering to a rise side may unite and may not be removed. For example, if an acrylic resin bead is used as a particle for an optical diffusion layer or light absorption stratification (and the binder), using a silica particle as a particle for acid-resisting processing, both particles can be mixed with ethyl acetate, coating liquid can be produced, after performing spin coating, a Fresnel lens sheet can be dipped in an alkaline solution etc., and only a silica particle can be removed alternatively. In addition, as for the thickness of the concavo-convex front face of a Fresnel lens side, it is desirable that it is 5 micrometers or less, and it is more desirable that it is 3 micrometers or less. The particle for acid-resisting processing of a lens side cannot be removed as it is more than this, the permeability of a lens sheet may be reduced or an

appearance may be spoiled.

[0016] In order to heighten the effectiveness of the centrifugal force when rotating a lens sheet at high speed and to make the particle for an optical diffusion layer or light absorption stratification adhere to a rise side much more alternatively, it is desirable that the specific gravity of the particle for an optical diffusion layer or light absorption stratification is larger than the specific gravity of the particle for acid-resisting processing. As for the specific gravity of the particle the optical diffusion layer over the specific gravity of the liniment liquid which does not contain each particle, or for light absorption stratification, it is desirable that they are 1.05 or more times, and, as for the specific gravity of the particle for acid-resisting processing, it is desirable that it is in the 0.95 to 1.05 times as many range as this.

[0017] As for the viscosity of the coating liquid used for a spin coat, it is desirable that it is the range of 0.01-50poise. If this range is exceeded and viscosity is too low, coating liquid may be unable to scatter and the particle for acid-resisting processing may be unable to be adhered to a lens side. When this range is exceeded and viscosity is too high, the particle for the acid-resisting processing on a Fresnel lens side may not fully scatter at the time of a spin coat, but decline in the permeability of a Fresnel lens sheet and degradation of appearance grace may be produced. As for the viscosity of coating liquid, it is more desirable that it is the range of 0.1-30poise. In addition, it is desirable that the rotational speed at the time of a spin coat is 500 or more revolutions per minute at the point which can fully fly about the particle for acid-resisting processing at the time of a spin coat.

[0018] Acid-resisting processing of the Fresnel lens side in the Fresnel lens sheet of

invention in this case The transparent material which has a refractive index lower than the ingredient which constitutes the Fresnel lens side other than the approach of forming a detailed concave convex in a front face as above-mentioned Two or more ingredients with the monolayer which consists of for example, (****-ized magnesium and a silica particle), and a different refractive index The multilayers which realized the low reflection factor combining (for example, metallic oxides, such as silicon, aluminum, zinc, titanium, a zirconium, and tin) may be formed in a Fresnel lens side. In addition, acid-resisting processing may be performed also to the plane of incidence 3 (drawing 1) of a Fresnel lens sheet.

[0019]

[Example] (Example 1) The configuration of the Fresnel lens manufactured by this example is the same as that of what shows some cross sections to drawing 1 . The height of each Fresnel lens is 0.1-70 micrometers. Moreover, the rise angle of a Fresnel lens is 5 degrees to the optical axis of a lens. The silica particle whose mean particle diameter is 0.04 micrometers as a particle for acid-resisting processing was used, the titanium oxide particle whose mean particle diameter is 6 micrometers as a particle for diffusion layer formation was used, ethyl acetate was mixed as acrylic resin and a solvent as a binder, and coating liquid was obtained. The viscosity of coating liquid was 1poise. This liniment liquid was carried out with ** with the spin coating method all over the Fresnel lens side by the side of outgoing radiation, and the rise side (rotational speed: 1500 revolutions per minute). Thereby, the titanium oxide particle could be made to adhere to homogeneity, and the optical diffusion layer was formed in the rise side. The titanium oxide particle of extent which affects the engine performance in a Fresnel lens side did not adhere, but the

film whose thickness containing a silica particle is 2 micrometers was formed. Subsequently, it washed, after dipping this Fresnel lens sheet into a 95-degree C sodium-hydroxide water solution. In the Fresnel lens sheet 1 manufactured by the above-mentioned approach, since the reflection factor in the Fresnel lens side 4 is low, it is hard to produce the unnecessary light L4 and L5 from the image light L1, and outgoing radiation of the transmitted light L3 is carried out at high effectiveness. Moreover, the unnecessary light L5 produced slightly was also diffused in the optical diffusion layer 6 of a rise side, and was able to control the outgoing radiation of unnecessary light sharply. for this reason, it is bright and generating of a ghost image is prevented -- having -- high -- the contrast image was able to be acquired.

[0020] (Example 1 of a comparison) The Fresnel lens sheet was produced like the example 1 except having not included a silica particle in coating liquid. Although the optical diffusion layer is formed in the rise side by this Fresnel lens sheet like the example 1, acid-resisting processing is not made in a Fresnel lens side. With the Fresnel lens sheet of the example 1 of a comparison, although generating of a ghost image was suppressed for a while, only the image darker than the Fresnel lens sheet of an example 1 was fully acquired.

[0021] (Example 2 of a comparison) The Fresnel lens was produced like the example 1 except having not included a titanium oxide particle in coating liquid. Although acid-resisting processing is performed to the Fresnel lens side by this Fresnel lens sheet like the example 1, the optical diffusion layer is not formed in the rise side. With the Fresnel lens sheet of the example 2 of a comparison, although generating of a ghost image was suppressed for a while and was brighter than the Fresnel lens sheet of the example 1 of a

comparison, as compared with the Fresnel lens sheet of an example 1, it was not able to be said to be sufficient level.

[0022]

[Effect of the Invention] According to invention in this case, generating of the ghost image by unnecessary light is controlled, contrast is good and the Fresnel lens sheet which has high permeability, and its manufacture approach are offered.